

## PATENT ABSTRACTS OF JAPAN

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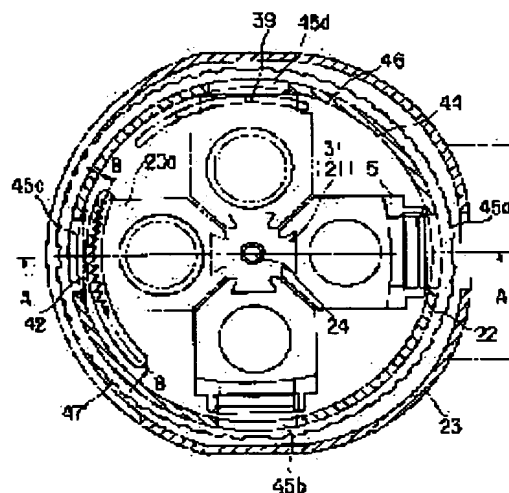
(72)Inventor : SUZUKI MOTOHIKO  
SHIBA SHINICHIRO  
JOGASAKI SHUYA  
MAJIMA AKIO

### (54) OPTICAL PATH CUT-OFF DEVICE

**(57)Abstract:**

**PROBLEM TO BE SOLVED:** To cut off an optical path so that strong light is not made incident on an observation system when a revolver lever or the like is switched by cutting it off by interlocking an optical cut-off member with such an action that an optical element is moved from the optical path by a switching mechanism.

**SOLUTION:** A turret device switching plural cubes including the dark turret filed cube 5 and the light visual field cube 20a by a rotary system is constituted by combining an inner turret 21 and an outer turret 22. After the turret 22 is rotated in advance of the turret 21 and the incident light of the illumination light with respect to the cube arranged outside the observation optical path is perfectly shielded, the turret 21 is started to be rotated. Thus, since the cube can be exchanged without making the illumination light incident on the observation optical path of an objective lens from the cube, the strong light is surely prevented from being made incident on the observation system when the cube is exchanged.



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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the optical-path interrupting device which intercepts a part of optical path in an optical microscope.

[0002]

[Description of the Prior Art] Although there are various methods as a speculum method of a microscope, the incident light dark field method is learned as one of the speculum methods suitable for observing the minute irregularity which exists on the surface of analyte.

[0003] The optical microscope constituted so that an incident light dark field method could be set to drawing 24 is shown. By the incident light dark field method, after changing into the parallel flux of light the illumination light which carried out outgoing radiation from the light source 1 of an optical microscope with a condenser lens 2, it lets the opening lens 3 and the field-diaphragm lens group 4 pass, and incidence is carried out to the dark field cube 5 arranged on the observation optical path of an optical microscope.

[0004] As shown in drawing 25, while changing the illumination light into the ring-like flux of light by the ring mirror 6 arranged in the dark field cube 5, a travelling direction is deflected to an objective lens 7 side. As the observation optical path 8 is formed in the core and an objective lens 7 surrounds the observation optical path 8 on the outside, the illumination-light way 9 is formed. The protection-from-light cylinder 10 has separated the observation optical path 8 and the illumination-light way 9. The ring-like flux of light deflected by the ring mirror 6 is drawn to an objective lens head through the illumination-light way 9 of an objective lens 7, and slanting lighting of the sample is carried out by the prism 11 formed at the head of an objective lens.

[0005] The reflected light from a sample side sets a lighting angle as the include angle which does not carry out direct incidence to the observation optical path 8 of the center of an objective lens. Therefore, incidence of the reflected light of the illumination light which carried out incidence to the part without the irregularity on the front face of a sample will be carried out to the observation optical path 8. On the other hand, if the illumination light carries out incidence to the irregularity on the front face of a sample, or the part of a blemish, dispersion will arise. This scattered light carries out incidence to the observation optical path 8, carries out incidence to the dark field cube 5 through the inside of the protection-from-light cylinder 10, penetrates the dark field cube 5, and is led to an ocular etc.

[0006] Here, the condition of the incident light to the objective lens 7 when switching the revolver 12 for dark fields holding an objective lens 7, and changing the scale factor of an objective lens 7 is explained. As shown in drawing 26, in case the optical axis of an objective lens 7 separates from a mirror body optical axis, the condition of carrying out incidence to the observation optical path 8 a part of whose ring-like illumination light from the dark field cube 5 is the inside of the protection-from-light cylinder 10 of an objective lens 7 arises temporarily.

[0007] Moreover, in order to switch to other speculum methods from a dark field speculum, also in case the dark field cube 5 is taken out out of an observation optical path, the condition of carrying out direct incidence to the observation optical path 8, without the illumination light going into the illumination-light way 9 as shown in drawing 27 arises.

[0008]

[Problem(s) to be Solved by the Invention] By the way, since the illumination light which carried out direct incidence to the observation optical path 8 of an objective lens 7 from the dark field cube 5 does not have an include angle to a sample side, the reflected light will carry out incidence of it to the observation optical path 8 of the direct objective lens 7, and it will be led to observation systems, such as an ocular.

[0009] Since the scattered light at the time of a dark field speculum has very little quantity of light, the amount of illumination light is raised at the time of a dark field speculum and, as for a sample, the high thing of a reflection factor is applicable in many cases, when the illumination light carries out incidence to the observation optical path 8 in such the condition, as for close, a strong light will go to an observation system through an objective lens 7.

[0010] This invention was not made in view of the above actual condition, and aims at offering the optical-path interrupting device which can intercept an optical path so that a light strong at the time of the change of a revolver etc. may not carry out incidence to an observation system.

[0011]

[Means for Solving the Problem] This invention provided the following means, in order to attain the above-mentioned object.

[0012] Incidence of this invention corresponding to claim 1 is carried out to the change-over device which inserts [ optical element ] to an optical path to said optical element, or it is equipped with the optical-path cutoff member which intercepts and opens the optical path of the light which carries out outgoing radiation, and a link means by which said change-over device interlocks said optical-path cutoff member with the actuation which moves an optical element from an optical path, and intercepts said optical path.

[0013] According to this invention, a change-over device inserts [ optical element ] to an optical path. When a change-over device moves an optical element from an optical path, an optical-path cutoff member is interlocked with transfer operation with a link means, and it is inserted in an optical path and shaded.

[0014] The body of a revolver with which this invention corresponding to claim 2 has the protection-from-light cylinder which separates an observation optical path and an illumination-light way, In the optical-path interrupting device with which the revolver equipment which consists of body of revolution in which two or more objective lens attaching holes in which it is attached in free [ a revolution ] to this body of a revolver, and an objective lens is attached were formed is equipped The converging section material which opens and closes the illumination-light way which is established in said body of a revolver and formed in the periphery of said protection-from-light cylinder, The protruding piece prepared in said body of revolution in the same pitch with said objective lens attaching hole, When it is prepared in said body of a revolver and said objective lens attaching hole is inserted in an observation optical path, when the aperture aforementioned objective lens attaching hole separates from said converging section material from an observation optical path in response to the force, it has the link member interlocked with revolution actuation of said body of revolution so that said converging section material may be closed from said protruding piece.

[0015] According to this invention, the objective lens arranged on an observation optical path by revolver equipment is switched. A link member \*\*\*\*\* in revolution actuation of revolver equipment. When it is prepared in the body of a revolver and an objective lens attaching hole is inserted in an observation optical path, a link member opens an aperture optical path for converging section material in response to the force from a protruding piece. Moreover, when an objective lens attaching hole strays off an observation optical path by revolution of revolver equipment, it operates so that a link member may close converging section material.

[0016] In the optical-path interrupting device with which the optical microscope which has the change-over device in which this invention corresponding to claim 3 inserts [ optical element ] to an optical path is equipped The protection-from-light member prepared possible [ insertion and detachment ] to the illumination-light way or observation optical path of said optical microscope, A detection means to detect whether said optical element is on an observation optical path, When it escapes from an optical path from said protection-from-light member when

said optical element is on an observation optical path based on the detecting signal of said detection means, and an optical path is opened and said optical element escapes from an observation optical path, a means to insert said protection-from-light member in an optical path is provided.

[0017] According to this invention, it is detected [ whether an optical element is on an observation optical path, and ] by the detection means, and when it is shown that an optical element has the detecting signal of a detection means on an observation optical path, it escapes from an optical path from a protection-from-light member, and an optical path is opened. Moreover, when an optical element shows that it escapes from an observation optical path, it inserts a protection-from-light member in an optical path, and a detecting signal intercepts an optical path.

[0018]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained.

[0019] (1st operation gestalt) The 1st operation gestalt is the example which applied the optical-path interrupting device concerning this invention to the turret equipment which switches a cube. The turret equipment which holds the dark field cube 5 and other cubes in the optical microscope shown in drawing 24 is explained to an example.

[0020] Drawing 1 - drawing 3 show the configuration of the turret equipment concerning this operation gestalt.

[0021] This turret equipment The dark field cube 5 and light field cube 20a While preventing that disturbance light carries out incidence into the outside turret 22 arranged so that the inner turret 21 and the inner turret 21 which can set four included cubes may be covered from a top-face side and the top face and peripheral face of the inner turret 21 may be surrounded, and a turret It consists of revolving-shaft 24 grades which support concentrically the housing 23 which prevents leakage \*\*\*\* of light, the inner turret 21, and the outside turret 22 free [ a revolution ].

[0022] The inner turret 21 is inserted in the core of the electrode-holder stanchion 31 free [ a revolution of a revolving shaft 24 ], and the electrode-holder stanchion 31 is supported by the revolving shaft 24 free [ a revolution ] through the bearing. The ant slot for attaching a cube is formed in the longitudinal direction of the peripheral face of the electrode-holder stanchion 31. The inner turret top plate 32 which makes discoid is really being fixed to the upper bed section of the electrode-holder stanchion 31 in the said alignment. As for the inner turret top plate 32, the optical-path aperture 33 is formed in four corresponding to a cube attaching position, and the periphery convex-like section 34 centering on a revolving shaft 24 is formed. V groove 35 for positioning a cube is formed at the predetermined spacing in four corresponding to a cube attaching position at the height 34. The stationary plate 36 is being fixed to the revolving shaft 24 which appeared in the top-face side of the inner turret top plate 32, and the fastball 38 is being fixed at the head through the flat spring 37. The fastball 38 is forced on the top face of the height 34 by the flat spring 37.

[0023] Moreover, the end face section of the stopper 39 which projected to the up side is being fixed to the predetermined location of a periphery by the top face of the inner turret top plate 32 rather than the height 34. Furthermore, the pin 41 is being fixed to the top face of the inner turret top plate 32, and the end of a coil spring 42 is connected to this pin 41. The other end of a coil spring 42 is connected to the pin 43 fixed to the outside turret side.

[0024] Drawing 4 shows the relation between the inner turret 21 which sandwiched the coil spring 42 in between, and the outside turret 22. a coil spring 42 -- a core [ center valve position / of a graphic display ] -- carrying out -- telescopic motion -- the deformable thing is used for both. A spring 42 is arranged in the slot attached to the outside turret, and the buckling of the spring 42 at the time of the direction revolution of A of an outside turret (the direction of a contraction of a spring 42) is prevented.

[0025] The outside turret 22 is supported free [ a revolution ] through the bearing by the part which penetrated the stationary plate 36 of a revolving shaft 24. In order to carry out incidence of the illumination light to the side attachment wall 44 of the outside turret 22 to the cube arranged on an observation optical path, four optical-path apertures 45a-45d are formed at

equal intervals. Here, optical-path aperture 45a of the outside turret 22 is set up so that it may be in agreement with the optical-path aperture of the cube arranged by the center valve position of the coil spring 42 usually connected with the inner turret 21 and the outside turret 22 by pins 41 and 43 on an observation optical path. Moreover, the long slot 46 where the stopper 39 which prepared in the inner turret 21 is inserted is formed in the top face of the outside turret 22.

When the optical-path aperture of a cube and the optical-path aperture 45 of the outside turret 22 are in agreement and a coil spring 42 is in a center valve position, it sets up so that a stopper 39 may become the mid-position of the long slot 46. a knurling tool 47 forms in the periphery of the outside turret 22 -- having -- \*\*\*\* -- the exterior from some housing 23 -- exposing -- the revolution from the outside -- it is operational.

[0026] Next, actuation of this operation gestalt constituted as mentioned above is explained.

[0027] As shown in drawing 1 and drawing 2, the inner turret 21 shall be equipped with the dark field cube 5 and light field cube 20a, and the dark field cube 5 shall be arranged at the observation optical path. This condition to the dark field cube 5 is removed from an observation optical path, and the actuation which arranges the cube of light field cube 20a or others to up to an observation optical path is as follows. That is, although a knurling tool 47 and the outside turret 22 fixed-sized will rotate centering on a revolving shaft 24 if the elastic force of a coil spring 42 is resisted in the predetermined direction and revolution actuation of the knurling tool 47 is carried out to it, the stopper 39 inserted in the long slot 46 of the outside turret 22 slides on the inside of the long slot 46, and the inner turret 21 does not rotate in the edge of the long slot 46.

[0028] Therefore, since only the outside turret 22 precedes with the inner turret 21 and rotates to a predetermined include angle, the optical-path aperture of the dark field cube 5 which was held in this phase at the inner turret 21, and has stopped on an observation optical path is covered in the outer wall 44 of the outside turret 22, and the incidence of the illumination light is interrupted.

[0029] If it continues carrying out revolution actuation of the knurling tool 47 in the same direction, since the outside turret 22 currently united with the knurling tool 47 will rotate, the turning effort to the same direction joins the inner turret 21 through the stopper 39 which is engaging with the long slot 46, a fastball 38 separates from V groove 35, and the inner turret 21 starts a revolution.

[0030] Here, it sets up so that the elastic force of a coil spring 42 may become weak rather than the sliding ability to the inner turret 21 of the fastball 38 energized by the flat spring 37. It means that the stopper 39 hit the long slot 46 of the outside turret 22 with as, and the inner turret 21 rotates until the following cube by which the inner turret 21 adjoins, the following click location 5, i.e., dark field cube, is arranged on an observation optical path by this.

[0031] Since the stationary plate 36 is being fixed to the revolving shaft 24, if the inner turret 21 rotates centering on a revolving shaft 24, the fastball 38 held through the flat spring 37 at the stationary plate 36 will slide on a height 34 top relatively. A fastball 38 fits into V groove 35 in the place where the following cube has been arranged on an observation optical path, and this lump this cube is positioned on an observation optical path.

[0032] After the following cube is positioned on an observation optical path, if a hand is lifted from a knurling tool 47, a coil spring 42 will be in a neutral condition in the place where the 45d of optical-path apertures and cube aperture of the outside turret 22 of return and the outside turret 22 corresponded according to the elastic force of a coil spring 42. Consequently, the illumination light will be in the condition in which incidence is possible from 45d of optical-path apertures of the outside turret 22 into a cube.

[0033] Thus, according to the gestalt of this operation, the turret equipment which switches two or more cubes by the rotating type is constituted combining the inner turret 21 and the outside turret 22. Since the inner turret 21 started the revolution after shading thoroughly the incidence of the illumination light to the cube which the outside turret 22 precedes with the inner turret 21, rotates, and is arranged on the observation optical path Cube exchange can be performed without producing the condition that the illumination light from a cube carries out incidence to the observation optical path of an objective lens 7, as shown in drawing 27, and it can prevent

certainly that a light strong at the time of a cube change carries out incidence to an observation system.

[0034] (2nd operation gestalt) The 2nd operation gestalt is the example which applied the optical-path interrupting device concerning this invention to the turret equipment which switches a cube. The turret equipment which holds the dark field cube 5 and other cubes in the optical microscope shown in drawing 24 is explained to an example.

[0035] Drawing 5 and drawing 6 show the configuration of the turret equipment concerning this operation gestalt. In addition, the same sign is given to the same part as the 1st above-mentioned operation gestalt.

[0036] This turret equipment While being supported by the turret body 51 which can be held at once, the revolving shaft 52 of this turret body 51, and the upper bed section of this revolving shaft 52 free [ sliding to the vertical direction ], four cubes It consists of closing motion plates 56a and 56b of the couple which is interlocked with lifting actuation of the link 54 and leaving in the middle 53 which transmit the force for carrying out lifting actuation of leaving in the middle 53 and leaving in the middle 53 by which migration of a hand of cut was regulated from the outside, and closes a shutter 55, and housing 57 grade.

[0037] The turret body 51 consists of an electrode-holder stanchion currently supported through the bearing like the above-mentioned inner turret by the revolving shaft 52 which has penetrated the core, and a turret top plate really formed in the upper bed section of this electrode-holder stanchion. The device for attaching a cube in the 4th page of an electrode-holder stanchion is established. Four optical-path apertures are formed in the turret top plate corresponding to the fitting location of a cube. In order to position a cube on the same periphery of the top face of a turret top plate corresponding to each cube, two or more slots 61 are formed. The tooth space for processing the interior of a turret top plate and sliding a link 54 in the direction of a path of a top plate is formed.

[0038] The link 54 is arranged so that the insertion edge 62 may be inserted in the leaving-in-the-middle 53 bottom through the core of an optical-path aperture from the peripheral face of a turret top plate. As shown in drawing 5, the link 54 has the annular section 63 for avoiding interference with an optical-path aperture. From a turret core, the insertion edge 62 of a link 54 becomes high gradually, is pressed towards a periphery, and has the field while it projects to the tooth space formed between the revolving shaft 52 and the turret top plate. The actuation edge of a link 54 has come out from the peripheral face of a turret top plate to the exterior, and the push button 64 is attached.

[0039] In addition, although only the link 54 is illustrated in drawing 5, the link 54 is formed for each [ which was formed in the turret body 51 ] optical-path aperture of every.

[0040] Leaving in the middle 53 is attached so that it may not rotate into the part which projects from the turret body 51 of a revolving shaft 52. The bottom inclined plane 65 which the link 54 pressed and had the dip corresponding to a field is formed in the underside side of leaving in the middle 53, a link 54 presses against the bottom inclined plane 65, and the field is pressed. The upside inclined plane 66 which inclines below gradually towards an outside from a leaving-in-the-middle core is formed in the top-face side of leaving in the middle 53. The flange which projects horizontally is really formed outside at the pars intermedia periphery to which the bottom inclined plane 65 and the upside inclined plane 66 intersect leaving in the middle 53. The click 67 is formed in the flange underside of leaving in the middle 53. The coil spring 68 which energizes leaving in the middle 53 caudad is formed between the top face of leaving in the middle 53, and housing 57. A cube is positioned by dropping into the slot 61 of a turret top plate the click 67 of the leaving in the middle 53 caudad energized with the coil spring 68.

[0041] As the closing motion plates 56a and 56b of a couple require the end face section side, they are arranged in the inclined plane of the truncated-cone section formed in the top-face side of leaving in the middle 53 in the upside inclined plane 66. Between the end face sections of the both sides of the closing motion plates 56a and 56b is connected with the coil spring 69. The closing motion plates 56a and 56b are supported free [ rotation ] with the supporting points 71a and 71b. Elastic force is committing the coil spring 69 in the direction which opens two closing motion plates 56a and 56b focusing on the supporting points 71a and 71b. Shutters 55a and 55b

are attached in the point of the closing motion plates 56a and 56b.

[0042] Next, actuation of this operation gestalt constituted as mentioned above is explained.

[0043] As shown in drawing 6, the turret body 51 shall be equipped with the dark field cube 5 and light field cube 20a, and the dark field cube 5 shall be arranged at the observation optical path. As shown in drawing 5, the closing motion plates 56a and 56b shall be opened with the coil spring 69, and, as for Shutters 55a and 55b, the illumination light shall have opened the optical path possible [ incidence ]. This condition to the dark field cube 5 is removed from an observation optical path, and the actuation which arranges the cube of light field cube 20a or others to up to an observation optical path is as follows. That is, if the push button 64 exposed out of housing 57 is pushed in in the direction of a turret core, the link 54 connected with the push button 64 will slide towards the core of leaving in the middle 53. Consequently, the insertion edge 62 of a link 54 presses, and a field resists and makes the bottom inclined plane 65 of leaving in the middle 53 the elastic force of a coil spring 68 (and coil spring 69). If leaving in the middle 53 goes up in accordance with a revolving shaft 52, it will rotate in the direction which the part from the end face section is mutually pushed on a reverse horizontal direction on the slant face of leaving in the middle 53, and the closing motion plates 56a and 56b close rather than the supporting points 71a and 71b. When the closing motion plates 56a and 56b close to the condition shown in drawing 5 R> 5 with a two-dot chain line, Shutters 55a and 55b close. Consequently, it will be thoroughly shaded by Shutters 55a and 55b, and incidence of the illumination light will not be carried out to the dark field cube 5.

[0044] On the other hand, if the leaving in the middle 53 pushed by the link 54 goes up in accordance with a revolving shaft 52 as described above, the click 67 dropped into the slot 61 of a turret top plate will separate, and the turret body 51 will come to rotate freely. If the turret body 51 rotates and the slot 61 corresponding to the following cube comes to a click location, the leaving in the middle 53 caudad energized with the coil spring 68 will fall downward, and click 67 will fall into the slot 61 concerned. While a push button 64 and a link 54 are returned to the original location at this time, since the upside slant face 66 of the leaving in the middle 53 which was rising among the closing motion plates 56a and 56b falls, the closing motion plates 56a and 56b are also opened by the elastic force of a coil spring 69. Consequently, the shutters 55a and 55b which had prevented the incidence of the illumination light change to an open condition. Thus, since the leaving in the middle 53 which carries out rise-and-fall actuation is formed, rise-and-fall actuation of leaving in the middle 53 is interlocked with and it was made to make the closing motion plates 56a and 56b and Shutters 55a and 55b open and close by the push button 64 and the link 54 according to this operation gestalt. In case a cube is switched, after shading the illumination light thoroughly, the turret body 51 can be rotated. Cube exchange can be performed without producing the condition that the illumination light from a cube carries out incidence to the observation optical path of an objective lens 7, and it can prevent certainly that a light strong at the time of a cube change carries out incidence to an observation system.

[0045] (3rd operation gestalt) The 3rd operation gestalt is the example which applied the optical-path interrupting device concerning this invention to the revolver equipment which switches an objective lens. The revolver equipment which holds an objective lens 7 in the optical microscope shown in drawing 24 is explained to an example.

[0046] Drawing 7 - drawing 10 show the configuration of the revolver equipment concerning this operation gestalt.

[0047] This revolver equipment consists of an anchoring seat 80 fixed to the body of a microscope, a body 82 of a revolver by which anchoring immobilization was carried out by the conclusion members 81, such as a screw, at this anchoring seat 80, body of revolution 84 attached in this body 82 of a revolver free [ a revolution ] through the ball bearing 83.

[0048] The protection-from-light cylinder 85 is arranged so that observation optical-path 86a may be formed in a core and, as for the anchoring seat 80, it may form illumination-light way 86b in the periphery centering on the observation optical axis of the body of a microscope. The point of the protection-from-light cylinder 85 is inserted in the optical-path hole of the body 82 of a revolver.

[0049] As for the body 82 of a revolver, the cylinder-like support piece 87 is formed in the core

twist from the optical-path hole at predetermined distance detached building \*\*\*\*\*. The end face section of the shields 88 and 89 of a couple is supported free [ a revolution ] with the screw 90 to the upper bed side of the support piece 87. Shields 88 and 89 open and close a screw 90 as the supporting point, as shown in drawing 7 , and they are processed into the configuration which can close illumination-light way 86b in the condition of having closed as a dotted line showed all over this drawing. Therefore, although shields 88 and 89 consist straight line-like of the end face section up to the predetermined location towards the point, if it hangs on a point from the point, they serve as a configuration bent according to the outer diameter of the protection-from-light cylinder 85.

[0050] From the supporting point with a screw 90, shields 88 and 89 are hung at the head of the end face section, cross mutually, and are arranged possible [ vertical movement of the cylinder-like pars intermedia material 91 ] in the meantime. Moreover, the spring 93 is wound around the support piece 87 located in the supporting point of shields 88 and 89. It is energizing in the direction which is made to engage with the stoppers 95a and 95b in which the ends 94a and 94b of a spring 93 were established by shields 88 and 89, and closes shields 88 and 89.

[0051] The pars intermedia material 91 is held for the vertical direction at the body 82 of a revolver, enabling free sliding, and is caudad energized by the elastic member 96 which consists of a spring wound around the periphery of the pars intermedia material 91. The taper sides 91a and 91b where it hangs on pars intermedia from each end face, and a diameter becomes thick continuously at the upper bed section and the soffit section of the pars intermedia material 91 are formed.

[0052] Body of revolution 84 has the objective lens hole 97 for attaching an objective lens 7. The pin 98 is set up by the location which counters body of revolution 84 with the soffit of the pars intermedia material 91 when the objective lens hole 97 has been arranged at the observation optical path. As for the pin 98, taper side 98a is formed in the periphery of a point. The minimum location of the pars intermedia material 91 is made into extent with which taper side 91b of the soffit section of the pars intermedia material 91 and taper side 98a of the point of a pin 98 lap, and taper side 91b of the pars intermedia material 91 slides on the taper side 98a top of a pin 98, and he is trying for the pars intermedia material 91 to go up.

[0053] Next, actuation of this example constituted as mentioned above is explained.

[0054] The objective lens 7 shall be attached in the objective lens hole 97 of body of revolution 84, and an objective lens 7 shall be arranged on an observation optical path, and dark field observation shall be performed. In this operating state, as shown in drawing 7 and drawing 9 , the pars intermedia material 91 is pushed up on a pin 98, and taper side 91a of the upper bed section of the pars intermedia material 91 forces the crossing of shields 88 and 89 on a supporting-point side to the maximum location, and is opening shields 88 and 89. Therefore, without being interrupted by shields 88 and 89, the illumination light of the shape of a ring generated by the dark field cube 5 passes the both sides of the protection-from-light cylinder 85, and carries out incidence to the illumination-light way 9 of an objective lens 7.

[0055] On the other hand, when exchanging an objective lens 7, body of revolution 84 is rotated until the objective lens of a request with revolver equipment goes into an optical path. When body of revolution 84 rotates and an objective lens 7 escapes from an observation optical path, in order that the pin 98 currently fixed to body of revolution 84 may move horizontally relatively to the pars intermedia material 91, as the pars intermedia material 91 caudad energized by the elastic member 96 slides down the taper side 98a top of a pin 98, it moves caudad. If the pars intermedia material 91 moves below, in order for the intersection of the shields 88 and 89 pushed on the supporting-point side in the major diameter of taper side 91a of the pars intermedia material 91 to contact the narrow diameter portion near the apical surface of taper side 91a of the pars intermedia material 91, an intersection moves to the way which keeps away from the supporting point. Consequently, it prevents that shields 88 and 89 are closed with the spring 93 energized in the direction which closes shields 88 and 89, and the bonnet illumination light carries out incidence of the periphery of the protection-from-light cylinder 85 to an objective lens 7.

[0056] Thus, according to this operation gestalt, the closing motion plates 88 and 89 which can

cover the periphery of the protection-from-light cylinder 85 which the illumination light passes in the interior of a revolver are formed. Since the closing motion plates 88 and 89 are interlocked with exchange actuation of an objective lens 7 and the closing illumination light was cut In case an objective lens is switched, after shading the illumination light thoroughly, an objective lens is exchangeable, an objective lens can be performed, without producing the condition that the illumination light from a cube carries out incidence to the observation optical path of an objective lens 7 as it is, and it can prevent certainly that a strong light carries out incidence to an observation system.

[0057] (4th operation gestalt) The 4th operation gestalt is the example which applied the optical-path interrupting device concerning this invention to the revolver equipment which switches an objective lens. The revolver equipment which holds an objective lens 7 in the optical microscope shown in drawing 24 is explained to an example.

[0058] Drawing 11 - drawing 15 show the configuration of the revolver equipment concerning this operation gestalt.

[0059] This revolver equipment is the example which changed the device for carrying out the switching action of the closing motion plates 88 and 89 in the 3rd above-mentioned operation gestalt. In addition, the same sign is given to the same part as the 3rd operation gestalt.

[0060] This revolver equipment is constituted by returning the rolling member 101 to an erection condition so that whenever [ crossed-axes-angle ] may be made small and the closing motion plates 88 and 89 may be closed, while pressing the intersection of the closing motion plates 88 and 89 to a supporting-point side, enlarging whenever [ crossed-axes-angle ] and making the closing motion plates 88 and 89 open by pushing down the rolling member 101.

[0061] The support device of the rolling member 101 is shown in drawing 13 (a).

[0062] As shown in this drawing, the member 102 which constitutes the end face section of the rolling member 101 is supported to revolve with the revolving shaft 103 which intersects perpendicularly with the rolling direction of the rolling member 101. The both ends of a revolving shaft 103 are being fixed to the body 82 of a revolver. The rolling member 101 is pulled by hard flow with the supporting point of the closing motion plates 88 and 89 with the spring 106 which the end connected to the body 82 of a revolver. And the rolling member 101 is maintained in the condition parallel to an optical axis by contacting installation in the stopper 105 which fixed to the body 82 of a revolver with the screw 104, and contacting the rolling member 101 in a stopper 105.

[0063] The pin 107 is set up by the location which shifted from the location where a member 102 meets when the objective lens 7 has been arranged at the observation optical path to body of revolution 84 slightly at the optical-axis side. As shown in drawing 1313 (b), the taper side in Yamagata where the side face of a pin 107 projects most in the center section is formed, and the head of the taper side projects to near the core of a member 102. It is the taper side in Yamagata where the side face of a member 102 also projects towards a pin 107 side. When an objective lens 7 is in agreement with an optical axis, it sets up so that a member 102 and the head of a pin 107 may contact.

[0064] Next, actuation of this example constituted as mentioned above is explained.

[0065] The objective lens 7 shall be attached in the objective lens hole 97 of body of revolution 84, and an objective lens 7 shall be arranged on an observation optical path, and dark field observation shall be performed. In this operating state, when a member 102 and the mutual head of a pin 107 contact so that it may expand to drawing 15 and may be shown, the rolling member 101 rolls by the RLC in drawing centering on a revolving shaft 103. Consequently, it will be in the condition that the point of the rolling member 101 presses the intersection of the end face section of the closing motion plates 88 and 89 in the direction of the supporting point, and a continuous line shows to drawing 14 R> 4. Therefore, the optical path which the closing motion plates 88 and 89 open greatly, and the illumination light passes in the periphery section of the protection-from-light cylinder 85 as shown in drawing 11 is secured.

[0066] On the other hand, when exchanging an objective lens 7, body of revolution 84 is rotated until the objective lens 7 of a request with revolver equipment goes into an optical path. Since engagement at a member 102 and a pin 107 separates when body of revolution 84 rotates and an

objective lens 7 escapes from an observation optical path, a stopper 105 is contacted in the place where the rolling member 101 pulled by the supporting point and hard flow with the spring 106 rotated to the circumference of drawing 12 Nakamigi centering on the revolving shaft 103 at, and became an include angle parallel to an optical axis. Since the part which was in contact with the intersection of the closing motion plates 88 and 89 in the upper bed section of the rolling member 101 moves to the location which keeps away from the supporting point at this time, it will be in the condition that the illumination-light way which the closing motion plates 88 and 89 closed and was formed in the periphery section of the protection-from-light cylinder 85 as whenever [ crossed-axes-angle / of the closing motion plates 88 and 89 ] became small and a dotted line showed to drawing 14 is taken up.

[0067] Thus, in case an objective lens is switched like [ according to this operation gestalt ] the 3rd above-mentioned operation gestalt, after shading the illumination light, an objective lens is exchangeable, an objective lens can be performed, without producing the condition that the illumination light from a cube carries out incidence to the observation optical path of an objective lens 7 as it is, and it can prevent certainly that a strong light carries out incidence to an observation system.

[0068] (5th operation gestalt) The 5th operation gestalt is the example which applied the optical-path interrupting device concerning this invention to epi-illumination equipment. The epi-illumination equipment for performing epi-illumination in the optical microscope shown in drawing 24 is explained to an example.

[0069] Drawing 16 shows the whole optical microscope configuration concerning this operation gestalt.

[0070] This optical microscope detects the insertion and detachment to the optical path of an objective lens 7 by the sensor 110 formed in the interior of a revolver 12. As shown in drawing 17, a sensor 110 is near [ each ] sensor component 110a prepared near the optical path of body of revolver 12a used as the fixed part of a revolver 12, and two or more objective lens attaching holes which body-of-revolution 12b has, and when an objective lens goes into an optical path, it consists of two or more sensor component 110b prepared in the location which meets sensor component 110a. A sensor 110 detects [ a contact process, a non-contact type, or ] whether the objective lens attaching hole and optical axis of body-of-revolution 12b were in agreement with the method of either electric, magnetic or a photoelectrical type.

[0071] Drawing 18 shows the configuration of the electrical circuit with which the above-mentioned optical microscope was equipped.

[0072] The output of a sensor 110 is inputted into the judgment circuit 111. The judgment circuit 111 judges IN/OUT to the optical path of an objective lens, and carries out closing motion control of the shutter 112 through the actuation circuit 113. The shutter 112 is arranged on the optical path in floodlighting tubing for leading the illumination light from the light source 1 to the cube arranged on an observation optical path. Therefore, if a shutter 112 is closed, the illumination light will not carry out incidence to the cube on an observation optical path. The actuation circuit 113 consists of either a motor or a solenoid.

[0073] Actuation of this operation gestalt constituted as mentioned above is explained with reference to drawing 19.

[0074] The objective lens 7 shall be attached in the objective lens hole of body-of-revolution 12b, an objective lens 7 and the dark field cube 5 shall be arranged on an observation optical path, and dark field observation shall be performed. In this condition, since sensor component 110b and sensor component 110 of body of revolver 12a a corresponding to the objective lens attaching hole of an objective lens 7 are in agreement, the coincidence detecting signal has inputted into the judgment circuit 111 from the sensor 110. While the coincidence detecting signal has inputted, the judgment circuit 111 is controlled through the actuation circuit 113, and secures an optical path so that a shutter 112 may be opened. Therefore, while the objective lens 7 is inserted on the observation optical path and dark field observation is performed, the illumination light from the light source 1 passes a shutter 112, and it carries out incidence to the dark field cube 5, and it turns into ring-like illumination light from there, and carries out incidence to the illumination-light way of an objective lens 7.

[0075] On the other hand, when exchanging an objective lens 7, while rotating body-of-revolution 12b and escaping from an observation optical path from an objective lens 7, the objective lens attached in the next objective lens attaching hole or other objective lens attaching holes is inserted on an observation optical path. If body-of-revolution 12b is rotated, since sensor component 110b currently fixed to body-of-revolution 12b separates from sensor component 110a used as a fixed part, the coincidence detecting signal currently outputted from the sensor 110 stops inputting into the judgment circuit 111. The judgment circuit 111 will intercept an optical path by closing a shutter 112 through the actuation circuit 113, if a coincidence detecting signal stops inputting. Therefore, it will be shaded by the shutter 112 and incidence of the illumination light from the light source 1 will not be carried out to the dark field cube 5. And when the sensor component prepared in the next objective lens attaching hole is in agreement with sensor component 110a, a coincidence detecting signal inputs into the judgment circuit 111, and an optical path is secured.

[0076] Thus, according to this operation gestalt, a sensor 110 detects coincidence with the objective lens attaching hole and optical axis which were prepared in body-of-revolution 12b of a revolver 12. Since it was made to close in the place which opened when the coincidence signal which shows what the shutter 112 arranged on the optical path in floodlighting tubing was inserted in the objective lens for by the optical path was outputted, and became an output halt of a coincidence signal. When the illumination light may carry out direct incidence to the observation optical path of an objective lens 7, the optical path of the illumination light can be intercepted, and it can prevent certainly that a strong light carries out incidence to an observation system.

[0077] (6th operation gestalt) The 6th operation gestalt is the example which applied the optical-path interrupting device concerning this invention to epi-illumination equipment. The epi-illumination equipment for performing epi-illumination in the optical microscope shown in drawing 24 is explained to an example.

[0078] Drawing 20 shows the partial configuration of the optical microscope concerning this operation gestalt. In addition, the same sign is given to the same part as the 5th operation gestalt mentioned above.

[0079] By meshing a gear 131 on the gear formed in body-of-revolution 12b of electric revolver 12', and rotating a gear 131 by the motor 132, it is constituted so that body-of-revolution 12b may be rotated and an objective lens may be switched. Revolution actuation of the motor 132 is carried out by the revolver driving signal from the carrier beam actuation circuit 134 in a change-over command signal from a controller 133. Moreover, closing motion actuation also of the shutter 112 arranged on the optical path in floodlighting tubing is carried out by the shutter driving signal from the carrier beam actuation circuit 134 in a closing motion command signal from a controller 133.

[0080] Drawing 21 shows the configuration of the electrical circuit in this operation gestalt.

[0081] As shown in this drawing, the actuation circuit 134 consists of shutter actuation circuit 134a which carries out closing motion actuation of the shutter 112, and revolver actuation circuit 134b which drives a motor 132. The controller 133 consists of the actuation input sections 142 and the display 143 grades which receive directions of the objective lens change from CPU141 which emits various commands, and an observer etc.

[0082] Actuation of this operation gestalt constituted as mentioned above is explained with reference to drawing 22.

[0083] If change-over directions of an objective lens are inputted into CPU141 from the actuation input section 142 of a controller 133, a shutter close command signal will be sent out from CPU141 to shutter actuation circuit 134a. An optical path is intercepted when shutter actuation circuit 134a closes a shutter 112 following a shutter close command signal. Therefore, it will be shaded by the shutter 112 and incidence of the illumination light from the light source 1 will not be carried out to a cube 5.

[0084] CPU141 sends out a revolver revolution command signal to revolver actuation circuit 134b, after shutter close control is completed. CPU141 which sent out the revolver revolution command signal maintains a revolver revolution command signal until a coincidence detecting

signal is inputted from a sensor 120. If the following objective lens is arranged on an observation optical axis in electric revolver 12' in which revolution actuation was carried out by carrier beam revolver actuation circuit 134b in a revolver revolution command signal, a coincidence detecting signal will be sent out from a sensor 120 to CPU141. CPU141 will suspend the output of a revolver revolution command signal, if a coincidence detecting signal is received from a sensor 120. Consequently, a revolution of a revolver stops and the following objective lens is arranged on an observation optical path. For example, if the objective lens directed from the actuation input section 142 is the following objective lens, a shutter open command signal will send out to CPU141 to shutter actuation circuit 134a, and a shutter 112 will be opened. Thereby, the optical path in floodlighting tubing is opened. If the above actuation is completed to the objective lens change-over directions inputted into the controller 133, a completion display will be outputted to a display 143 and processing will be ended.

[0085] In addition, when objective lens change before is [ the objective lens change back ] a light field speculum in a light field speculum, there is a case the illumination light may carry out [ a case ] direct incidence to the observation optical path of an objective lens like. Such a case is beforehand registered into the controller 133, and when it corresponds to this case, it is made not to perform optical-path cutoff control which was described above.

[0086] Thus, according to this operation gestalt, since it was made to perform optical-path cutoff control at the time of an objective lens change in the controller 133, optical-path cutoff control is realizable in the form included in the content of control of a controller 133.

[0087] (7th operation gestalt) Drawing 23 shows the partial configuration of the optical microscope concerning this operation gestalt. In addition, the same sign is given to the same part as the optical microscope shown in drawing 24.

[0088] This optical microscope detects the change of the cube by turret equipment 151 by the sensor 152 while it switches the cube arranged on an observation optical path with the turret equipment 151 by which two or more cubes were attached and corresponds to modification of a speculum method. A sensor 152 consists of sensor component 152b prepared in the turret equipment 151 side corresponding to each cube, and sensor component 152a which meets sensor component 152b in the condition that each cube has been arranged on an observation optical path.

[0089] The shutter 153 is arranged on the optical path by which the light which passed the cube arranged on an observation optical path goes to observation systems, such as an ocular. The detecting signal outputted from a sensor 152 is inputted into the actuation circuit 154. The actuation circuit 154 sends out the command signal which makes a shutter 153 open and close based on the detecting signal outputted from a sensor 152 to a motor 155.

[0090] If according to this operation gestalt constituted as mentioned above turret equipment 151 is rotated in order to exchange the cube 5 on an observation optical path, the signal which shows that the sensor components 152a and 152b stop having been in agreement, and the turret rotated from the sensor 152 to the actuation circuit 154 will input. If a revolution detecting signal is received from a sensor 152, it will control by the actuation circuit 154 to give a command to a motor 155 and to close a shutter 153. Consequently, in case a cube 5 escapes from on an observation optical path, the condition that it is shown in drawing 27 arises, and a strong light reflected by the sample carries out incidence to exchange and an inner cube through the observation optical path of an objective lens 7. However, since a strong light which passed the cube is shaded by the closed shutter 153, carrying out incidence to an observation system is lost.

[0091] As mentioned above, although this invention was explained based on the gestalt of operation, this invention is not limited to the above-mentioned thing, and includes the following invention.

[0092] In the optical-path interrupting device with which the slewing gear which rotates and switches the optical element which holds two or more optical elements and is arranged on an optical path is equipped The optical-path cutoff member it inserts [ member ] to the optical path of the illumination light which carries out incidence to said optical element, It has the link member which is interlocked with revolution actuation of rotating said rolling mechanism, and

inserts said optical-path cutoff member in said optical path before the revolution of said rolling mechanism, and the elastic member energized so that an optical-path disconnection condition may be maintained in said link member after the optical element change by said rolling mechanism.

[0093] According to this invention, the slewing gear holding two or more optical elements rotates and switches the optical element arranged on an optical path. At this time, a link member is interlocked with revolution actuation of rotating a rolling mechanism, and an optical-path cutoff member is inserted in an optical path before the revolution of a rolling mechanism. Moreover, it is held at the condition that a link member maintains an optical-path disconnection condition in response to elastic force from an elastic member after the optical element change by the rolling mechanism.

[0094]

[Effect of the Invention] As a full account was given above, according to this invention, the optical-path interrupting device which can intercept an optical path so that a light strong at the time of the change of a revolver, a cube, etc. may not carry out incidence to an observation system can be offered.

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[Translation done.]

**JPO and NCIP are not responsible for any damages caused by the use of this translation.**

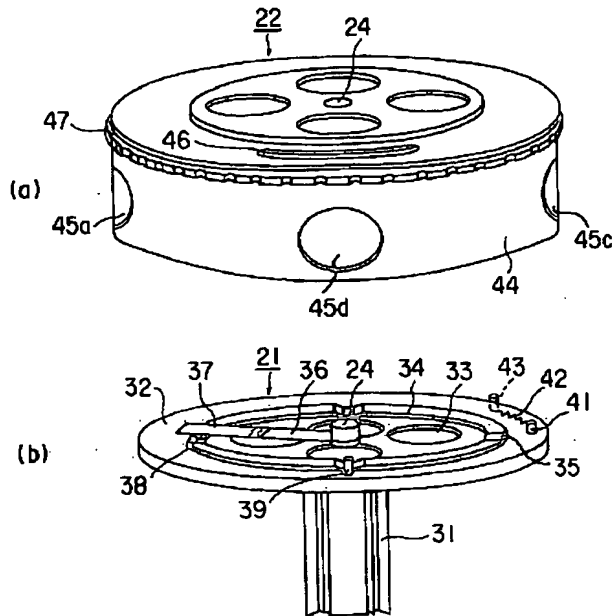
2.\*\*\*\* shows the word which can not be translated.

**3. In the drawings, any words are not translated.**

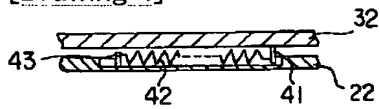
[Drawing 1]



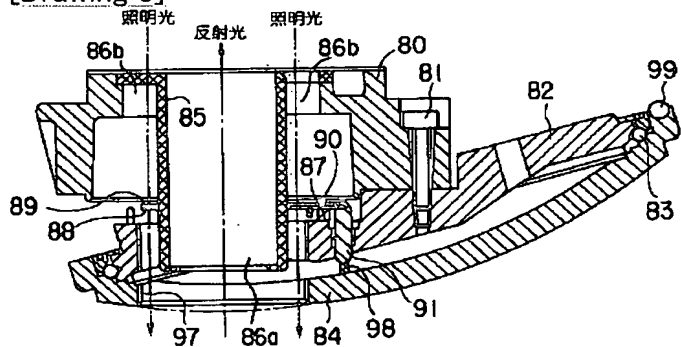
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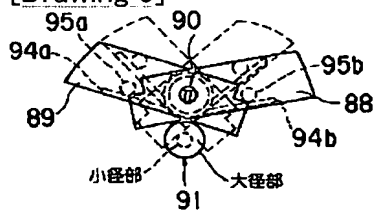
[Drawing 4]



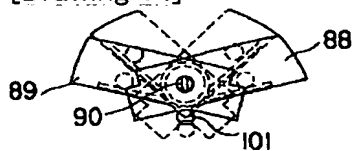
[Drawing 8]



[Drawing 9]

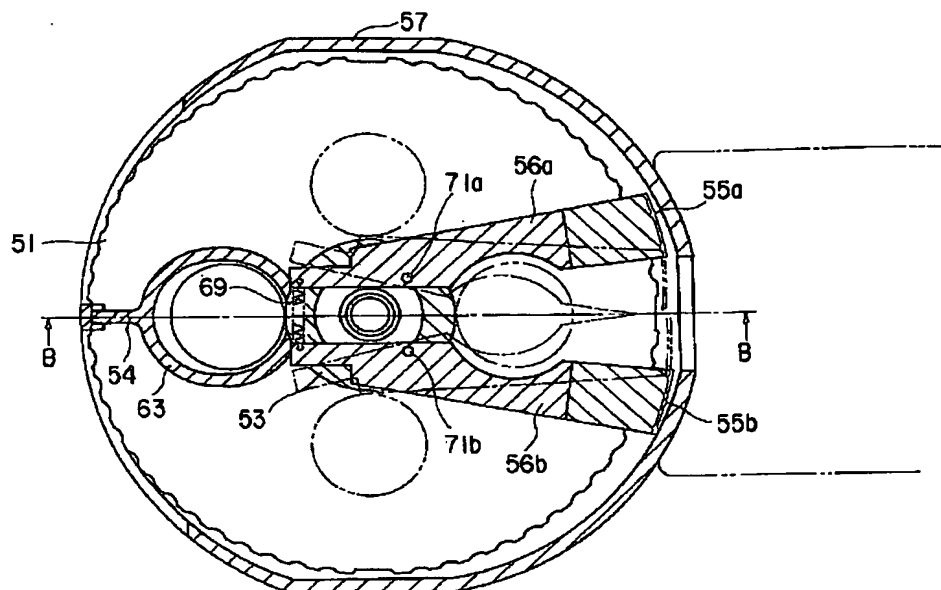


[Drawing 14]

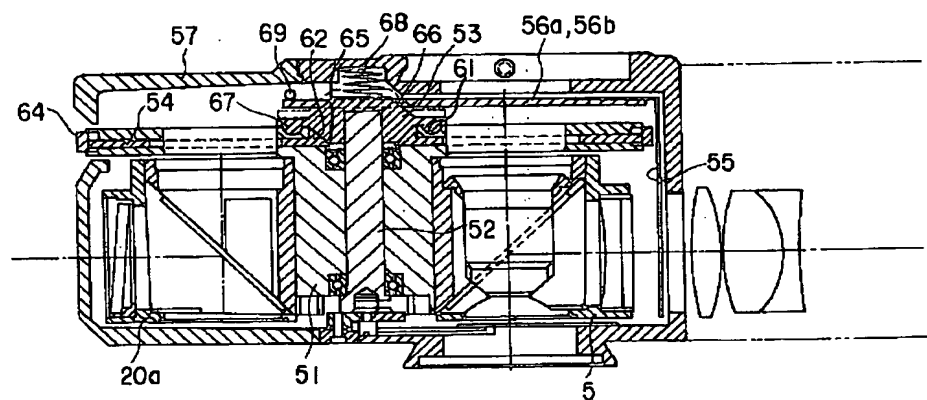


[Drawing 5]

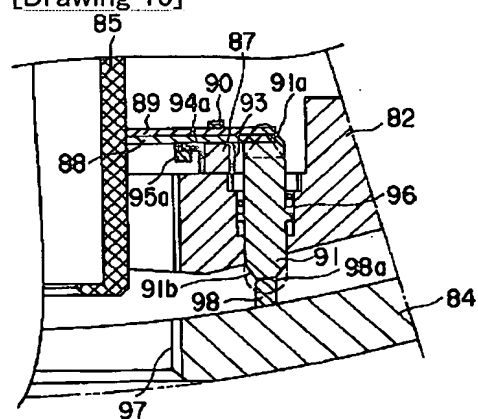
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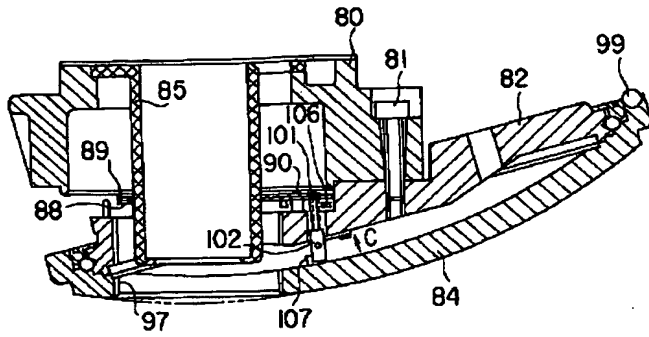
[Drawing 6]



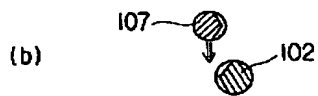
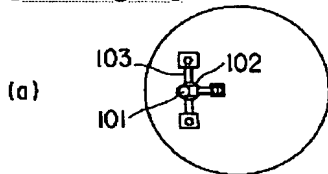
[Drawing 10]



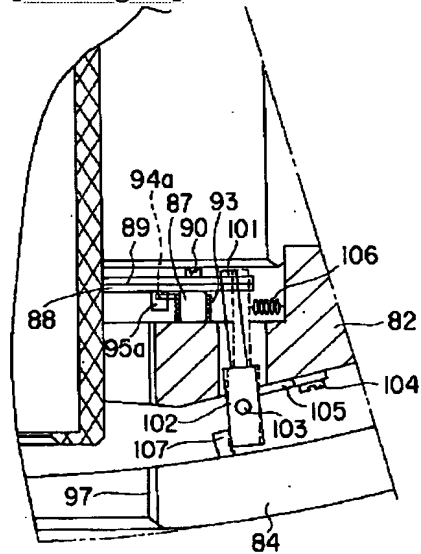
[Drawing 12]



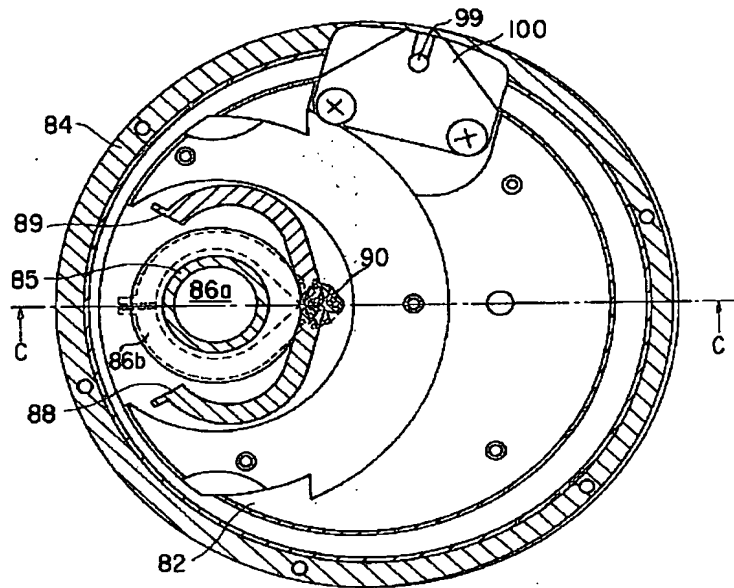
[Drawing 13]



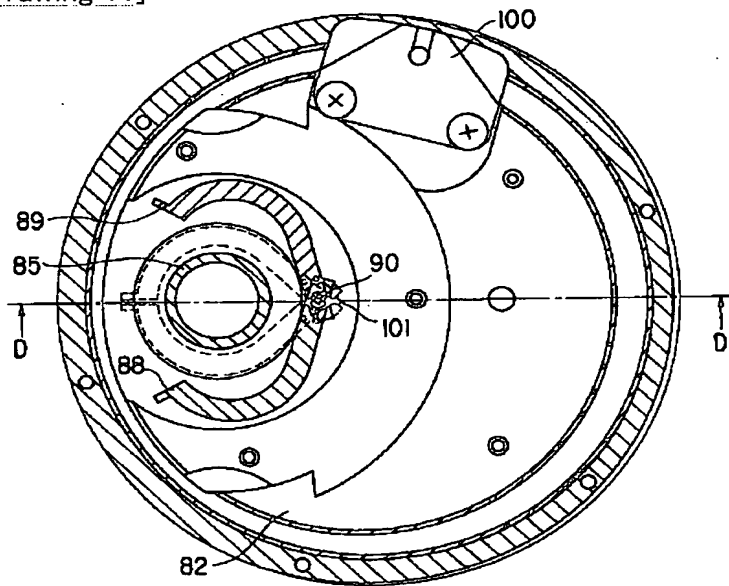
[Drawing 15]



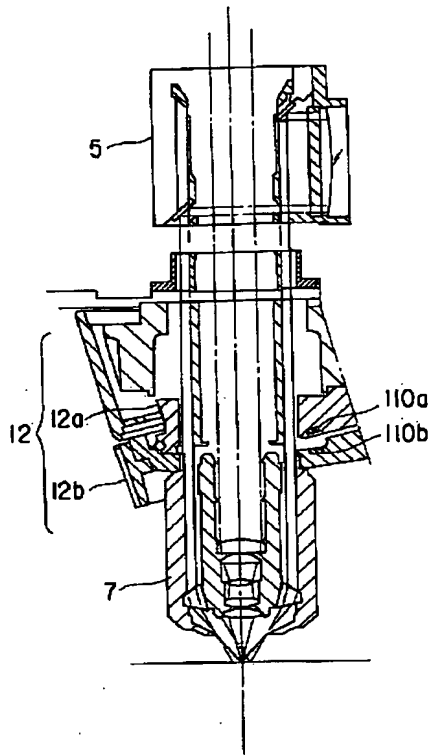
[Drawing 7]



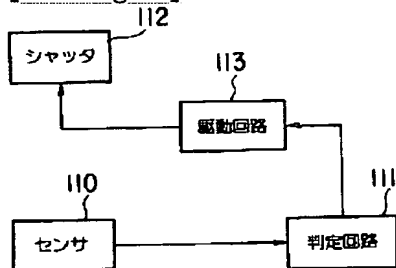
[Drawing 11]



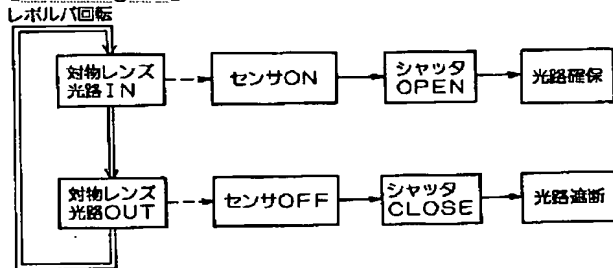
[Drawing 17]



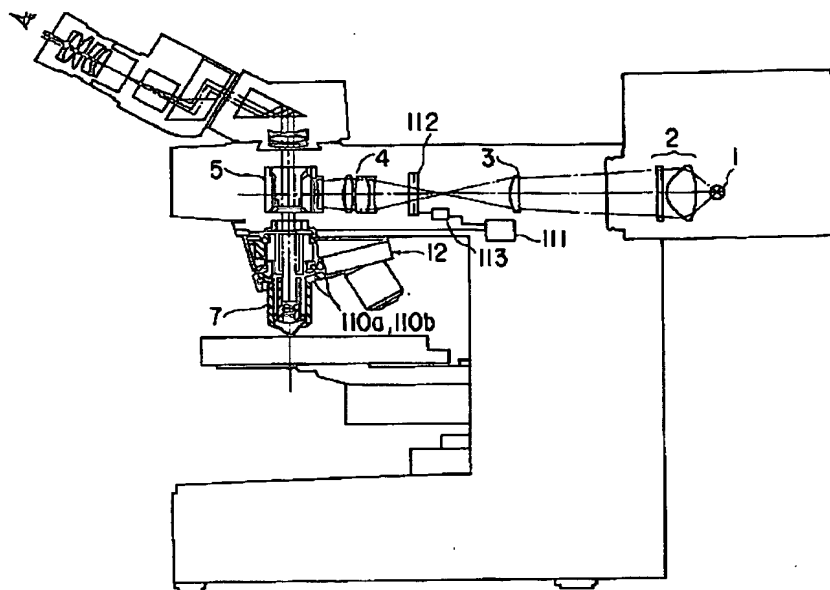
[Drawing 18]



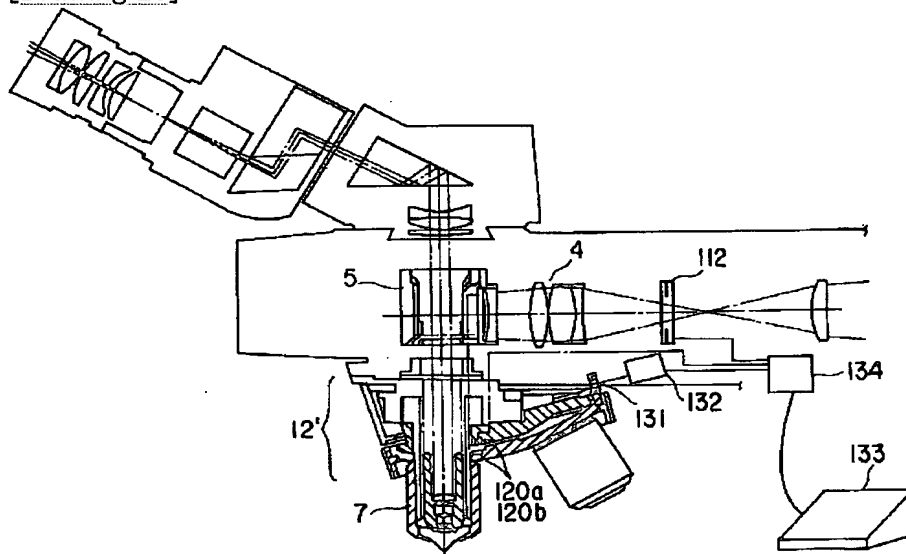
[Drawing 19]



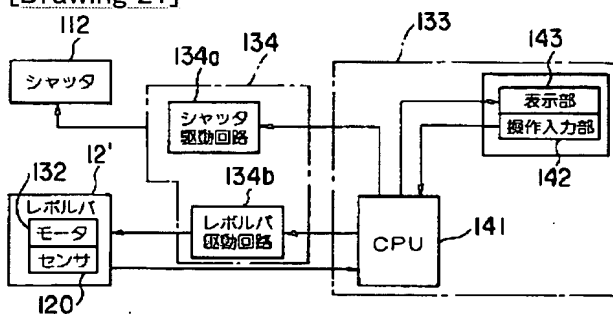
[Drawing 16]



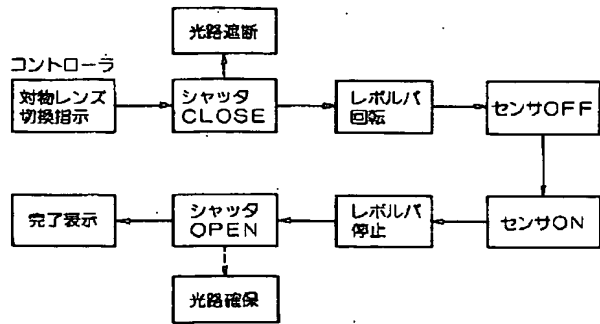
[Drawing 20]



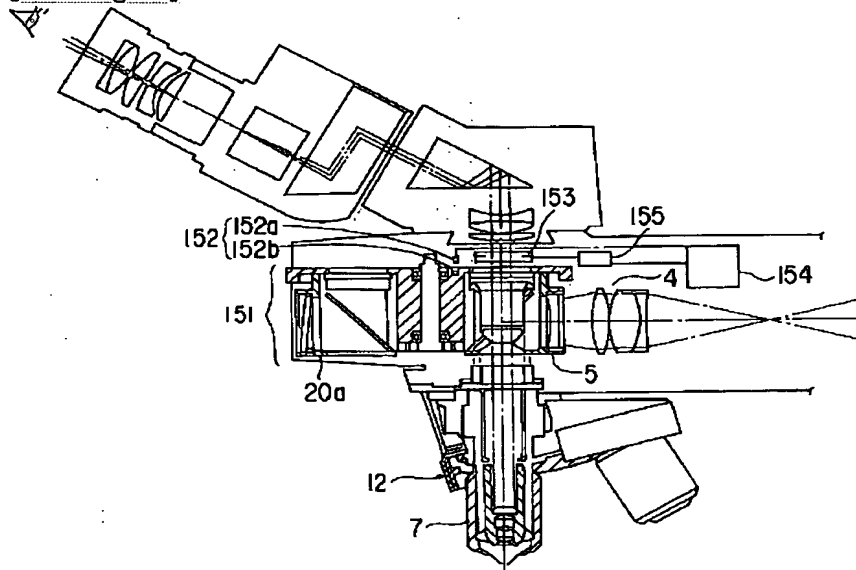
[Drawing 21]



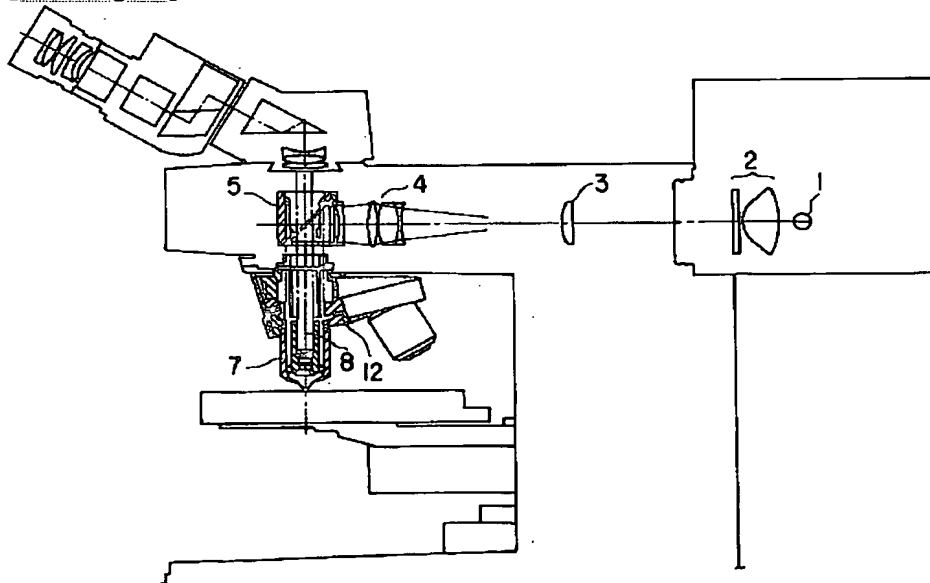
[Drawing 22]



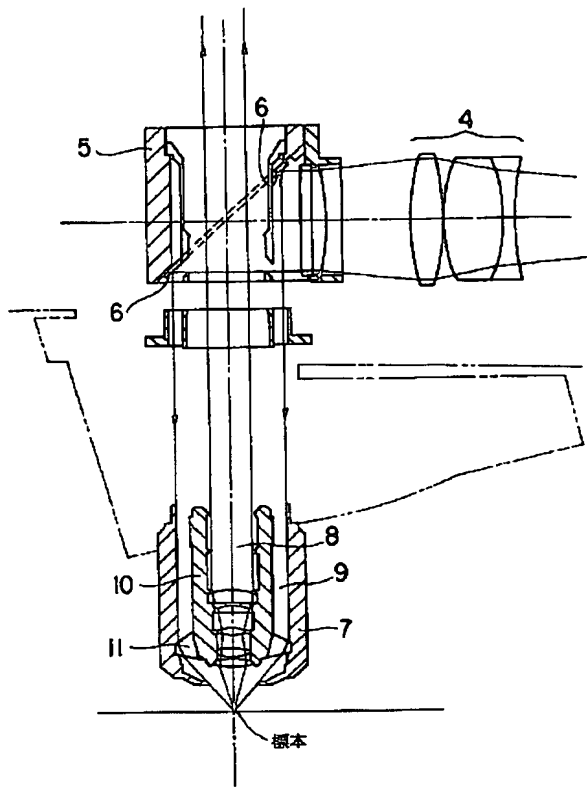
[Drawing 23]



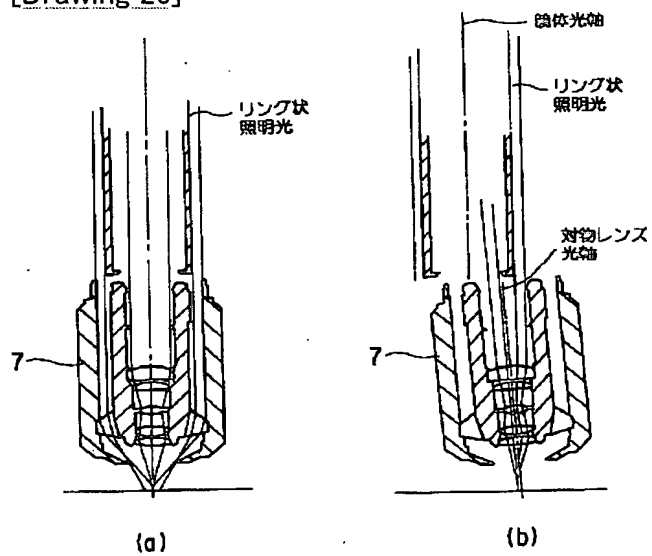
[Drawing 24]



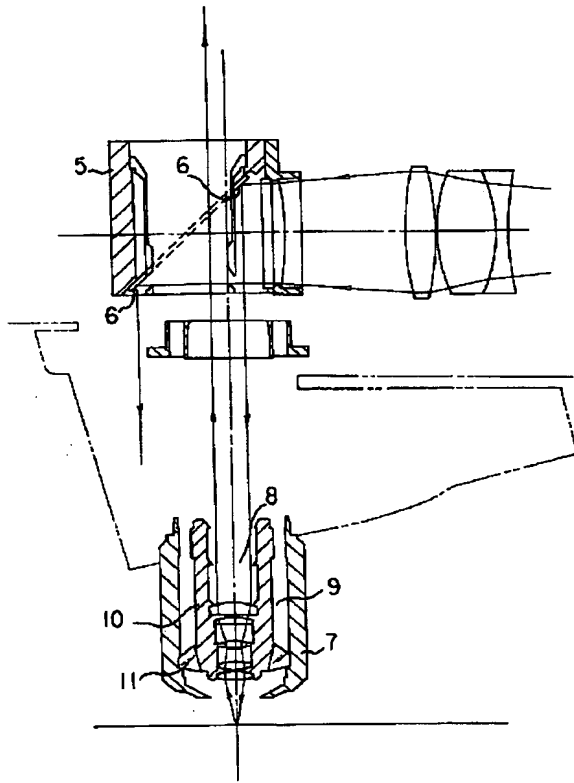
[Drawing 25]



[Drawing 26]



[Drawing 27]



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[Translation done.]